COMPARISON OF DEFUZZIFICATION METHODS FOR FUZZY STOCHASTIC LINEAR PROGRAMMING

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ABSTRACT

The present study focused on comparison of three defuzzification methods in transforming fuzzy two-stage stochastic linear programming problem into a crisp problem. The fuzzy transformation techniques that utilized in this study were Yager's robust ranking method, generalized mean integration representation (GMIR) method, and centroid defuzzification method (CDM). Besides that, an assumption that the probability distribution obtained via expert was fuzzy and consisted only partial information was made. Five problems which modified based on Dakota's Furniture Company were presented to give an illustration on how the fuzzy transformations using the three mentioned techniques were carried out. The defuzzified two-stage stochastic linear programming problems from each of the techniques were solved using a modelling system of GAMS, which implemented using a solver called DECIS. The difference between first problem and the rest of the problems was demand levels in first problem were symmetric triangular fuzzy numbers. Transformation of first problem using three different techniques resulted in getting the same model formulation, and hence the result obtained from GAMS/DECIS obviously was similar. The results of Problem 2 and Problem 3 obtained from the GAMS/DECIS showed a slight difference in resource quantities, production quantities, and the total profit, and CDM method showed the best optimum solutions. Meanwhile, GMIR method showed better optimum solutions in Problem 4 and 5. Hence, it can be concluded that CDM and GMIR are best methods of defuzzification for non-symmetric triangular fuzzy numbers problems comparing to Yager's robust ranking method.

ABSTRAK

Kajian ini fokus kepada perbandingan tiga teknik penyahkaburan dalam mentransformasi masalah pengaturcaraan linear stokastik dua peringkat kabur kepada masalah nyata. Teknik transformasi kabur yang digunakan dalam kajian ini adalah kaedah kedudukan teguh Yager, kaedah perwakilan integrasi min umum (GMIR) dan kaedah penyahkaburan sentroid (CDM). Selain itu, andaian dibuat bahawa taburan kebarangkalian diperolehi melalui pakar adalah kabur dan mengandungi hanya separa informasi. Lima masalah yang telah diubah berdasarkan Syarikat Perabot Dakota telah dibentangkan untuk memberi ilustrasi bagaimana transformasi kabur menggunakan tiga teknik yang disebut tadi dilakukan. Masalah pengaturcaraan linear stokastik dua peringkat yang telah dinyahkaburkan dari setiap teknik diselesaikan menggunakan sistem permodelan GAMS, yang mana dilaksanakan menggunakan penyelesai dipanggil DECIS. Perbezaan di antara masalah pertama dan masalah-masalah yang lain adalah tahap permintaan dalam masalah pertama merupakan nombor kabur segitiga simetri. Transformasi bagi contoh pertama menggunakan tiga teknik yang berbeza menghasilkan pembentukan model yang serupa, dan justeru itu keputusan yang diperolehi melalui GAMS/DECIS semestinya serupa. Keputusan bagi masalah kedua dan ketiga yang diperolehi melalui GAMS/DECIS menunjukkan perbezaan yang sangat sedikit dalam kuantiti sumber, kuantiti pengeluaran dan jumlah keuntungan, dan teknik CDM menunjukkan penyelesaian optimum yang terbaik. Sementara itu, teknik GMIR menunjukkan penyelesaian optimum terbaik dalam masalah ke-empat dan ke-lima. Justeru itu, dapat disimpulkan bahawa CDM dan GMIR merupakan teknik penyahkaburan yang terbaik bagi masalah nombor kabur segitiga tidak simetri berbanding dengan kaedah kedudukan teguh Yager.